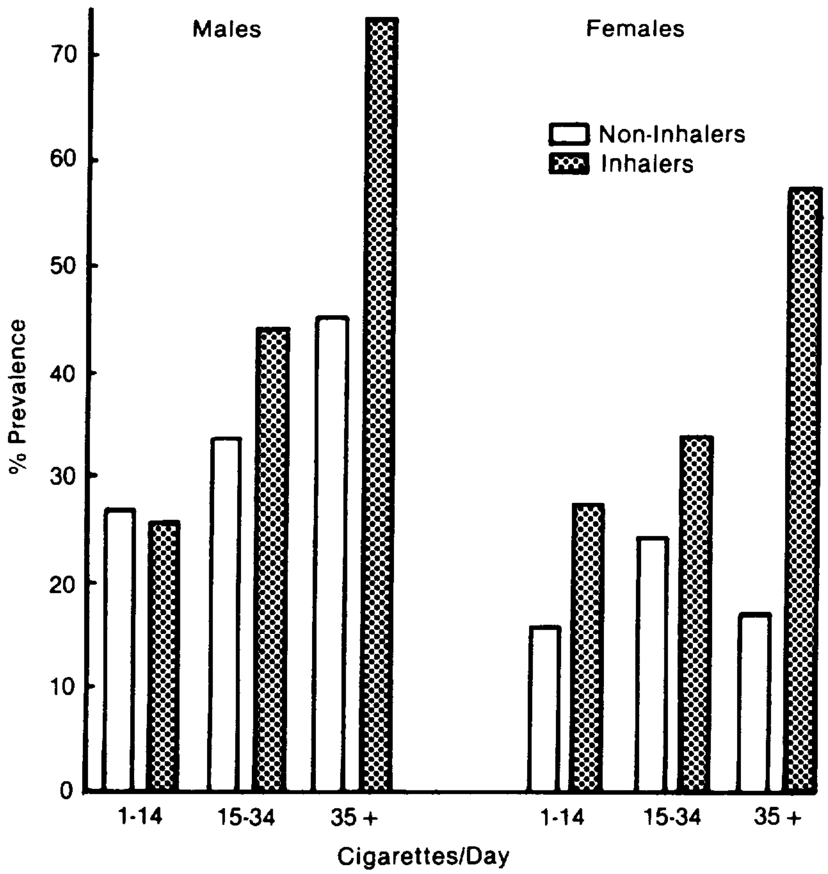

FIGURE 1.—Age-standardized rates (percent) of chronic nonspecific respiratory disease* by inhaling and current cigarette smoking

*Criteria for diagnosis were as follows:

(1) Chronic bronchitis: Affirmative response to the question—Do you bring up phlegm from chest six or more times a day for four days a week for three months a year for the past three years or more?

(2) Asthma: Affirmative response that bronchial asthma had been diagnosed and was still present.

(3) Chronic obstructive lung disease: Affirmative response to one or more of the following: wheezing or whistling in the chest occurred most days or nights; the subject had to stop for breath when walking at his own pace on the level; FEV_1 less than 60 per cent of the FVC.

These could occur in various combinations and were not mutually exclusive.

SOURCE: Ferris, B.G., Jr. (22).

smoking histories were comparable. Rawbone et al., in a questionnaire survey of 10,498 secondary school children aged 11 to 17 in London, found a significantly higher frequency of cough,

TABLE 10.—Respiratory symptoms and diseases in male (M) and female (F) participants in Charleswood (C)—urban—and in Portage La Prairie (P)—rural—expressed as percent of respondents

Respiratory Symptom/Disease	Nonsmokers C	Nonsmokers P	Ex-Smokers C	Ex-Smokers P	Smokers C	Smokers P
Cough on most days, at least 3 months/year						
M	8.3	4.0	8.1	2.9	25.4	31.5
F	—	4.0	—	10.0	20.3	31.7
Phlegm on most days, at least 3 months/year						
M	—	4.0	10.8	5.7	16.9	24.7
F	—	4.0	—	5.0	10.2	25.4
Wheezing apart from colds						
M	4.2	8.0	10.8	14.3	26.8	31.5
F	3.5	8.0	12.1	20.0	25.4	30.2
Attack of shortness of breath and wheezing						
M	4.2	8.0	13.5	11.4	11.3	17.8
F	—	12.0	6.1	15.0	13.5	20.6
Shortness of breath compared to persons of same sex and age						
M	8.3	4.0	5.4	5.8	5.6	12.3
F	7.0	12.0	6.1	5.0	22.1	17.5

SOURCE: Manfreda, J. (39).

colds, and exertional dyspnea in regular smokers as compared to nonsmokers (45). There was no appreciable difference in the frequency of cough between male and female smokers or between male and female nonsmokers. Colley et al. examined the influence of smoking, lower respiratory tract illness under 2 years of age, social class of father, and air pollution on respiratory symptoms in a cohort of 20-year-olds followed since birth (15). Their data (Table 12) suggest that respiratory symptoms were closely related to current smoking. Symptoms were also related to a history of lower respiratory tract infection in the first 2 years of life but were not related to social class or air pollution.

TABLE 11.—Smoking and the prevalence of respiratory symptoms in girls from two different cities in England

		Prevalence of Symptom With Each Group						
		Smoker[+]		Experimental Smoker†		Nonsmoker		
Symptom	Residence	N	%	N	%	N	%	Significance*
Cough in the morning	Kent	10	31.3	51	9.8	73	6.9	P <0.001
	Derbyshire	14	18.9	50	8.4	138	6.7	P <0.001
Cough day or night	Kent	17	53.1	148	28.0	195	18.4	P <0.001
	Derbyshire	35	47.3	176	29.5	458	22.1	P <0.001
Cough for 3 months of year	Kent	5	15.6	43	8.2	55	5.2	P <0.01**
	Derbyshire	10	13.5	32	5.4	82	4.0	P <0.001

[+] Smoker = a child who smoked at least one cigarette a week.

† Experimental smoker = a child who had smoked at sometime but less than one cigarette a week.

*Test for significant association of cough and smoking habit. Chi-square 2 × 3 table.

**Smokers and experimental smokers combined to give chi-square on a 2 × 2 table.

SOURCE: Bewley, B.R. (9).

TABLE 12.—Prevalence (percent) of respiratory symptoms by sex and smoking habit in cohort of 3,898 20-year-olds followed since birth

History of Cigarette Smoking	Population		Winter Morning Cough Q.1(a)+		Cough Day or Night in Winter Q.1(b)+		Cough 3 Months in Winter Q.1(c)+		Winter Morning Phlegm Q.2(a)+		Phlegm Day or Night in Winter Q.2(b)+		Phlegm 3 Months in Winter Q.2(c)+		Persistent Cough and Plegm Q.1(c) +2(c)+	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Never smoked cigarettes	802	1093	1.6	4.0	5.2	6.5	1.5	3.2	4.8	5.2	6.4	3.9	3.7	3.2	0.9	1.9
Ex-smokers of cigarettes	101	57	3.0	1.8	7.1	10.5	3.0	1.8	11.0	1.9	10.2	9.1	6.0	0.0	2.0	0.0
Present smoker of cigarettes	1009	678	13.0	13.2	13.9	16.0	8.1	7.5	14.1	11.9	11.6	11.2	8.3	5.5	4.9	3.5
No data on cigarette smoking	92	48	8.7	11.8	9.1	18.8	4.5	0.0	0.0	6.7	4.8	0.0	4.8	0.0	4.8	0.0
All	2022	1876	7.7	7.4	9.8	10.2	5.0	4.7	9.9	7.6	9.3	6.7	6.2	3.9	3.0	2.4

+1. (a) Do you usually cough first thing in the morning in the winter?
(b) Do you usually cough during the day or at night in the winter?
If "Yes" to either question 1(a) or (b)
(c) Do you cough like this on most days for as much as three months each winter?

2. (a) Do you usually bring up any phlegm (spit from the chest) first thing in the morning in the winter?
   (b) Do you usually bring up any phlegm (spit from the chest) during the day or at night in the winter?
   If "Yes" to either question 2(a) or (b)
   (c) Do you bring up phlegm (spit from the chest) on most days for as much as three months each winter?

SOURCE: Colley, J.R.T. (15).

TABLE 13.—Percentages of nonsmokers and smokers with abnormal test results in three North American cities, using combined reference values*

	Men						Women					
	Nonsmokers			Smokers			Nonsmokers			Smokers		
	AS (95)*	S (27)	Total (122)	AS (12)	S (115)	Total (236)	AS (145)	S (46)	Total (191)	AS (107)	S (98)	Total (205)
Upper limit +	1.6	0.2	1.8	1.8	1.8	2.6	2.1	0.6	2.4	1.7	1.7	2.4
Lower limit +	11.6	20.0	10.6	10.6	10.9	8.7	10.0	15.0	9.1	11.1	11.5	9.0
1. Abnormal test												
FEV-FVC	6	11	7	5	7	6	4	20	8	7	25	16
CV/VC	2	7	3	13	17	15	6	11	7	23	26	25
CC/TLC	2	7	3	20	32	26	8	17	10	20	29	25
ΔN/L	1	7	3	17	13	15	7	24	11	27	37	32
RV/TLC	6	11	7	9	9	9	8	9	8	11	13	12

*Reference values for nonsmokers derived from asymptomatic nonsmokers in the three cities.
**Numbers in parenthesis = number of subjects in each group.
+Upper and lower limits in the expected 5 percent abnormal results.
AS = asymptomatic; S = symptomatic
SOURCE: Buist, A.S. (11).

In a longitudinal study of elderly Edinburgh residents aged 61 to 90, Millne and Williamson found the prevalence of persistent cough and sputum production was significantly greater in smokers of both sexes than in their nonsmoking counterparts (40). Male prevalence rates were three times higher than those in females; however, no attempt was made to determine the relationship of respiratory symptoms to life-time tobacco exposure.

In summary, many recent studies demonstrate a higher frequency of respiratory symptoms in women who smoke as compared to women who do not smoke. This is true in surveys including children, adolescents, young adults, working age, and elderly women. The effect of cigarette smoking is related in terms of both the number of cigarettes and years smoked. The majority of studies indicate a greater prevalence of respiratory symptoms among men who smoke than among women who smoke; however, these differences often disappear when the study is carefully controlled for smoking history.

Smoking and Pulmonary Function

The insensitivity of cough and sputum production in the adult as a predictor of future development of COLD has been emphasized by Fletcher and Peto (29). Pulmonary function testing offers an objective method for measuring the adverse effects of smoking. However, current tests of pulmonary function display a marked variability between individuals and may not detect the development of COLD until irreversible damage of the lung has occurred. Also, none of the presently used pulmonary function tests can predict which of those individuals with slightly abnormal pulmonary function will progress to debilitating and life-threatening emphysema and chronic bronchitis. Becklake and Permutt have recently reviewed the objectives and problems of the tests of lung function commonly used for early detection of COLD (7).

A large number of studies have established a higher frequency of pulmonary functional abnormalities in smokers as compared to nonsmokers. These studies have examined (a) the relationship of smoking to abnormal tests of small airway function and (b) the relationship of smoking to measurements of standard spirometry. The majority of epidemiologic surveys investigating the prevalence of functional abnormalities in smokers have employed spirometric measurements, usually the forced expiratory volume (FEV) and vital capacity (VC). Measurements of airway resistance, diffusing capacity, lung volume, and nitrogen mixing have been used much less frequently.

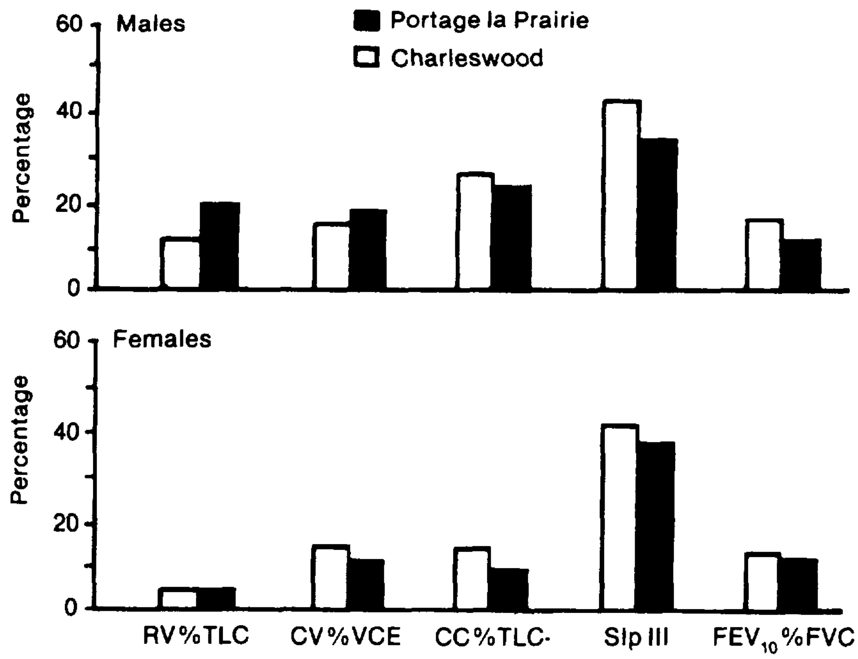

FIGURE 2.—Prevalence of lung function abnormalities among smokers in an urban (Charleswood) and a rural (Portage La Prairie) community

SOURCE: Manfreda, J. (39).

SMOKING AND "EARLY" FUNCTIONAL ABNORMALITIES

The most widely used measurements for detecting early change of chronic airflow obstruction are the single-breath nitrogen washout curve or a maximum forced expiratory volume curve.

A limited number of recent studies using tests of small airway function have included appreciable numbers of female subjects. They have demonstrated a higher frequency of abnormalities in tests of small airway function in smokers than in nonsmokers or ex-smokers. A definite dose-response relationship has been found in some of these studies but not in others (10,11,12). Table 13 shows the data from one of these studies (11). For all measures of small airway function, the frequency of abnormalities was higher among smokers than nonsmokers in both men and women. The frequency of abnormal measurements was considerably higher in female smokers than in male smokers except for closing capacity, in which equal proportions of male and female smokers performed abnormally. However, the frequency of abnormalities among female nonsmokers was also greater than among male nonsmokers. The authors speculate that the traditional view of chronic airflow obstruction as being predominantly a disease of males may be accurate only when male smokers outnumber female smokers and when males smoke more cigarettes than females. They suggest that when women's smoking habits become comparable to those of men, the effect on lung function may be similar.

Manfreda et al. used the single-breath nitrogen test in a large group of subjects in two Canadian cities (Figure 2) (39). Almost all smokers (85 percent) reported that they inhaled their cigarettes. Smokers had a greater prevalence of abnormalities than nonsmokers regardless of sex. The prevalence of abnormal values in women who smoke was slightly less than in male smokers.

In a volunteer population of 530 cigarette smokers attending an emphysema screening center, Buist and Ross found an equivalent frequency of abnormalities of the slope of phase III among male and female smokers of less than 20 cigarettes per day (Figure 3) with both sexes having significantly higher prevalence of abnormalities among smokers of more than 20 cigarettes per day (12). In the groups smoking more than 20 cigarettes a day, a greater proportion of females demonstrated abnormalities than males. However, the age composition of each group (male and female) was not identical.

A recent study of small airway function in 205 young volunteer smokers aged 18 to 25 has suggested that smoking may exert its effects at different anatomic locations in the lungs of men and women (21). All subjects smoked fairly heavily (more than 20 cigarettes per day) for a short period of time (average: 2.4 pack-years). Male smokers showed frequent abnormalities in tests of small airway function but female smokers did not exhibit these abnormalities. Both male and female smokers showed decreased forced expiratory flows at high lung volumes, suggesting the presence of large-airway dysfunction in young smokers. Male and female smokers differed significantly in their response to $He\text{-}O_2$ inhalation. Female smokers showed at least as great an improvement in forced expiratory flows with $He\text{-}O_2$ as did female nonsmokers. In contrast male smokers showed a much smaller response to the $He\text{-}O_2$ at high lung volumes. Thus, the predominant female response to habitual cigarette smoking appears to have been involvement of the large airways, but men who smoked appeared to have developed abnormalities in small airway function. The reason(s) for the differences in the data derived from this study and previously

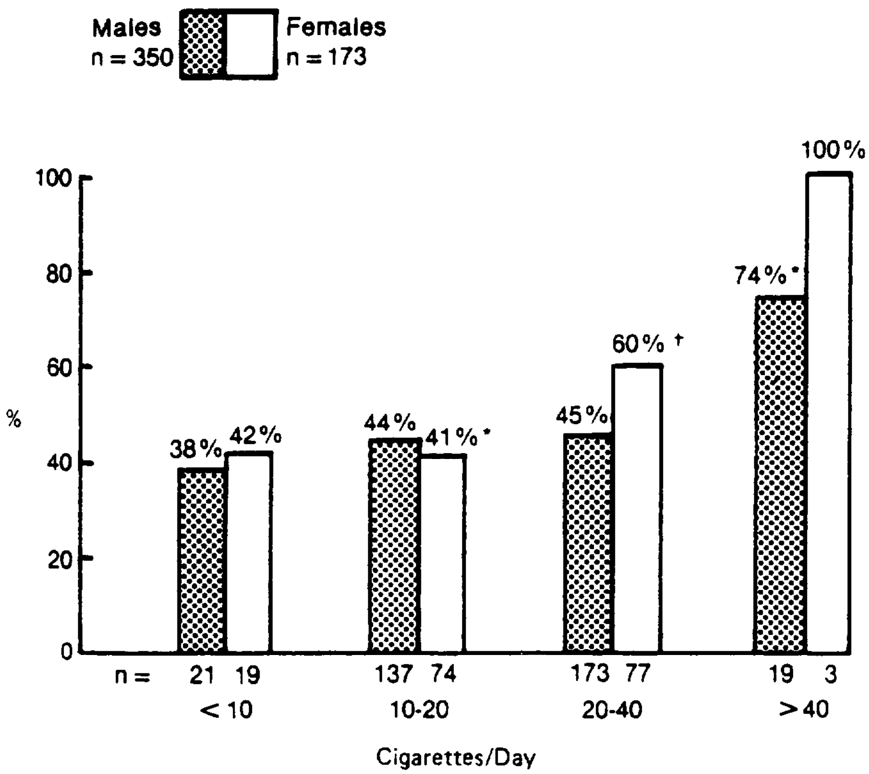

FIGURE 3.—Percentage of male and female cigarette smokers with an abnormal change in nitrogen concentration ($\triangle N_2$) per liter according to their daily cigarette consumption

*Indicates a significant difference between groups using 20 to 40 cigarettes per day as the reference group (P <0.05).

†Indicates significant differences between males and females (P <0.05).

SOURCE: Buist, A.S. (12).

cited reports relating smoking to small airway dysfunction (11,12,39) is unclear.

In summary, a limited number of recent studies have demonstrated a higher frequency of abnormalities in tests of small airway function in female smokers as compared to female nonsmokers and ex-smokers. It is not clear whether these abnormalities are dose-related. Female smokers may have more frequent abnormalities in the slope of phase III than male smokers. Male smokers may have more frequent abnormalities in closing volume than female smokers. The meaning of these differences is unclear. One study has suggested that the earliest effects of smoking on lung function may occur in the large airways in women and small airways in men.

SMOKING AND VENTILATORY FUNCTION

The majority of studies examining the relationship of smoking to ventilatory capacity have used some measurement of forced expiratory volume. Most of these studies have focused on male populations and have found a close relationship between cigarette smoking and the presence of abnormal pulmonary function (2,6,16,20). Furthermore, the decrement in performance measured by simple spirometry is dose-related to the numbers of cigarettes smoked (6,16,20). Relatively few studies have included appreciable numbers of females.

Woolf examined pulmonary function in 500 women volunteers (65). Smokers demonstrated significantly lower values for FVC, FEV, FEF 25–75 percent, and specific conductance than nonsmokers and ex-smokers who had not smoked for over a year; this suggests that at least some abnormalities of pulmonary function are reversible with smoking cessation.

Higgins and Keller examined the relationship of smoking to seven derivatives of the forced vital capacity curve in 3,109 males and 3,256 females aged 10 and older (35). Nonsmokers performed better than smokers in both sexes. Values consistently decreased with increasing cigarette consumption. The largest differences were in FEV and FEF 25–75 percent.

Seltzer et al. examined the relationship of smoking to FVC in 65,086 white, black, and Asian subjects aged 20 to 79 who had attended a Kaiser-Permanente multiphasic health clinic (49). The authors found a significant reduction in FVC among white women who smoked as compared to nonsmoking white women. No such differences were found for black and Asian subjects, however. No explanation for this racial difference was apparent from their data.

In a study by Buist et al., the prevalence of abnormalities of FEV_1/FVC was higher in female smokers than nonsmokers (11). The frequency of abnormalities in FEV_1/FVC among female smokers was twice that of male smokers (Table 12). Gibson et al. examined the relationship of smoking to measurements of the forced vital capacity in 18,359 men and women in Australia (30). Nonsmokers had better lung functions than smokers. Among smokers of 10 or more cigarettes a day, men showed a greater decrement in lung function than women.

Burrows et al. examined the relationship of smoking to measurements of forced expiratory volume in 883 men and 1,166 women in Tucson, Arizona (13). Nonsmokers performed better

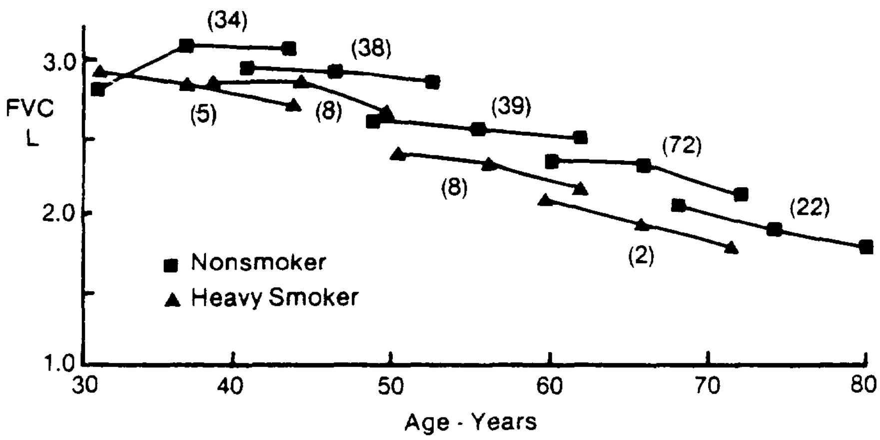

FIGURE 4.—Changes in forced vital capacity (FVC) by age in various female cohorts

Results have been standardized to 155 cm and are body temperature and pressure saturated (BTPS).
Numbers in parentheses are number in that cohort.
Heavy smokers are those who smoke 25 or more cigarettes per day.
SOURCE: Ferris, B.G., Jr. (23).

than ex-smokers or smokers, and ex-smokers performed better than smokers in both sexes. Smokers of more than 20 cigarettes per day performed worse than smokers of fewer than 20 cigarettes per day. There were no significant differences in the regression for FEV_1/FVC on pack years in men and women, suggesting that men and women with equivalent smoking habits have similar decrements in FEV_1/FVC.

The long-term effects of smoking on pulmonary function have been scrutinized in two prospective studies. In the Framingham study, 5,209 adults have been followed since 1948 with biennial examinations including measurements of forced vital capacity (3). Longitudinally, cigarette smokers showed a more rapid decline in forced vital capacity than nonsmokers. Men and women who continued to smoke had a more rapid decline in FVC than those who had stopped. The rate of decline in pulmonary function was appreciably steeper in male smokers than female smokers. The authors suggest that these differences could be due to differences in smoking habits.

In a longitudinal study of residents of Berlin, New Hampshire, Ferris examined the changes in pulmonary function by smoking status in the various age cohorts (23). Among females, heavy and moderate smokers had lower values for FVC and FEV_1 as compared to nonsmokers, and the values fell more

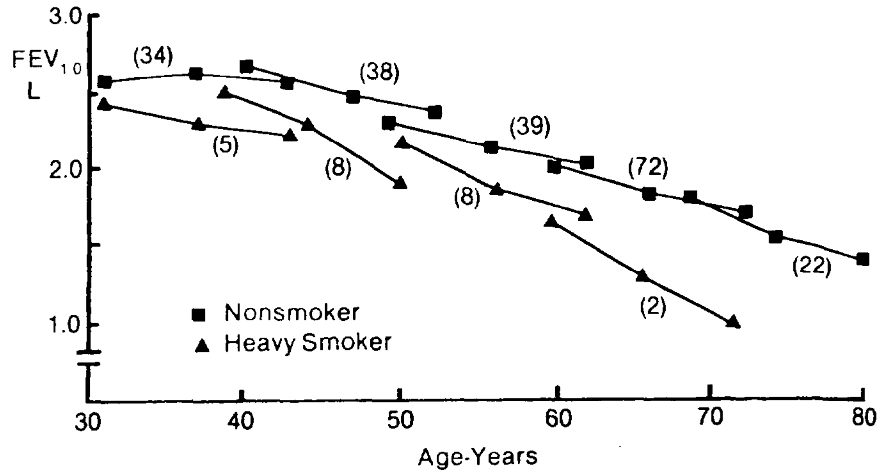

FIGURE 5.—Changes in forced expiratory volume in 1 second ($FEV_{1.0}$) by age in various female cohorts

Results have been standardized to 155 cm and are body temperature and pressure saturated (BTPS).
Numbers in parentheses are number in that cohort.
Heavy smokers are those who smoke 25 or more cigarettes per day.
SOURCE: Ferris, B.G., Jr. (23).

rapidly with age. These relationships for heavy smokers (25 or more cigarettes a day) are presented in Figures 4 and 5.

In summary, women smokers perform worse on spirometric testing than do female ex-smokers or nonsmokers. This relationship appears to be dose-related to the number of cigarettes smoked. The differential effects of smoking on pulmonary function in males and females is unclear. One study demonstrated that men and women with equivalent smoking habits have similar decrements in FEV_1/FVC. The long-term effect of smoking on pulmonary function has been evaluated in two studies which included appreciable numbers of females. Longitudinally, women who smoke show a more rapid decline in forced vital capacity than women who do not smoke. Women who continue to smoke have a more rapid decline in forced vital capacity than those who stop; however, men who continue to smoke have an even more rapid decline in pulmonary function than women who continue to smoke. The long-term relationship between respiratory symptoms and airflow obstruction in women is unknown. One large prospective study could not find a relationship between symptoms and the ultimate development of chronic airflow obstruction in men (29).

Summary

1. Recent statistics indicate a rising death rate due to chronic obstructive lung disease (COLD) among women. The data available demonstrate an excess risk of death from COLD among smoking women over that of nonsmoking women. This excess risk is much greater for heavy smokers than for light smokers.

2. Women's total risk of COLD appears to be somewhat lower than men's, a difference which may be due to differences in prior smoking habits.

3. The prevalence of chronic bronchitis varies directly with cigarette smoking, increasing with the number of cigarettes smoked per day.

4. There is conflicting evidence regarding differences in the prevalence of chronic bronchitis in women and men. Several recent studies suggest that there is no significant difference in the prevalence of chronic bronchitis between male and female smokers. This may be the result, however, of increasingly similar smoking behavior of women and men.

5. The presence of emphysema at autopsy exhibits a dose-response relationship with cigarette smoking during life.

6. There is a close relationship between cigarette smoking and chronic cough or chronic sputum production in women, which increases with total pack-years smoked.

7. Women current smokers have poorer pulmonary function by spirometric testing than do female ex-smokers or nonsmokers, a relationship which is dose-related to the number of cigarettes smoked.

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INTERACTION BETWEEN SMOKING AND OCCUPATIONAL EXPOSURES.

INTERACTION BETWEEN SMOKING AND OCCUPATIONAL EXPOSURES

The 1979 Surgeon General's Report on the health consequences of smoking (18) examines the interaction of smoking and occupational exposure. Ways in which smoking may interact with the occupational environment are described and examples of these interactions are discussed. Briefly, these types of interaction are:

1. Tobacco products may serve as vectors by becoming contaminated with toxic agents found in the workplace, thus facilitating entry of the agent by inhalation, ingestion, and/or skin absorption of the agent.
2. Workplace chemicals may be transformed into more harmful agents by smoking.
3. Certain toxic agents in tobacco products and/or smoke may also inhabit the workplace, thus increasing exposure to the agent.
4. Smoking may contribute to an effect comparable to that which can result from exposure to toxic agents found in the workplace, thus causing an additive biological effect.
5. Smoking may act synergistically with toxic agents found in the workplace to cause a much more profound effect than that anticipated simply from the separate influences of the agent and smoking added together.
6. Smoking may contribute to accidents in the workplace.

Although few of the studies discussed in the 1979 Surgeon General's Report included enough women to adequately determine the health risks of smoking and the occupational environment, it is reasonable to hypothesize that women with the same occupational exposure and smoking behavior as men would develop health effects similar to those demonstrated in men. However, the interaction of smoking and the occupational environment and its effect on women differs in at least two ways:

First, smoking patterns among women are different from those among men—women are less likely to smoke, and if they do, they smoke fewer cigarettes per day, inhale less, and are more likely to smoke lower "tar" and nicotine cigarettes (7,14,18). Second, smoking and occupational exposure may adversely affect the fetus or the health of the mother during pregnancy. Smoking and occupational exposure may also interact with methods of contraception chosen by women.

This chapter reviews each of these reasons for a differential health impact on men and women and examines two occupational exposures where interactions with smoking have been clearly demonstrated for women workers.

TABLE 1.—Smoking habits of working women by title and industry

Industry	Percent of Current Female Labor Force*	Percent Non-Smokers	Percent Ex-Smokers	Present Smokers ≤ 1 pack per day	Present Smokers ≥ 1 pack per day
Professionals					
Health	4.4	51.2	16.6	25.2	6.9
Teachers	6.8	63.5	14.0	19.8	2.7
Other	4.6	53.4	15.1	24.0	7.5
Managerial, incl. office, rest., sales, administrator	6.7	42.7	16.4	28.0	12.1
Sales	6.2	46.0	16.2	30.0	8.0
Clerical					
Bookkeepers	4.6	53.1	12.2	26.5	8.2
Office machine operators	1.3	52.8	15.7	23.1	8.4
Secretaries	13.3	52.0	14.7	26.3	7.0
All other	14.2	50.6	13.6	27.5	8.3
Crafts	2.4	46.4	13.1	31.8	8.6
Operatives	11.8	52.8	10.1	31.6	5.5
Service					
Cleaning	2.5	51.9	12.8	31.2	4.1
Food	6.6	40.0	13.4	39.8	6.8
Health	6.9	52.1	10.5	32.2	5.2
Private Household Workers	2.8	62.4	10.1	24.7	2.8

*Figures are subject to sampling errors and may therefore not agree with those in other tables.
SOURCE: National Center for Health Statistics (6).

Smoking Patterns in Women

The male-female differences in smoking behavior and the change in patterns of smoking behavior in women over time are reviewed in other sections of this report. It is important, however, to consider the impact of these trends when evaluating the interaction of smoking and the environment. Regular cigarette smoking is a behavior that usually begins between the ages 12 and 25 (18). It is unusual to begin regular smoking after the age

TABLE 2.—Estimates of the percentage of current, regular cigarette smokers, adults ages 20 years and over, according to labor force status and occupation and sex, U.S., 1976

	Female			Male		
	Total 20+	20–44	45–64	Total 20+	20–44	45–64
Total	32.0	36.9	34.8	41.9	47.6	41.3
Currently employed	35.9	37.0	36.1	43.4	46.8	39.7
White collar total	34.3	33.8	36.9	36.6	38.6	35.3
Professional technical and kindred	29.1	28.6	32.7	30.0	31.1	29.9
Managers & administrators except farm	41.6	42.7	40.8	41.0	46.4	36.1
Sales workers	38.1	37.0	42.6	39.9	42.6	38.0
Clerical & kindred workers	34.8	34.7	36.0	40.4	40.1	44.2
Blue collar total	39.0	43.7	33.6	50.4	54.1	44.3
Craftsmen & kindred workers	40.5	46.9	35.6	48.0	52.1	41.6
Operatives and kindred workers	37.6	42.5	31.2	52.3	55.3	46.2
Laborer, except farm	56.3	52.6	*	53.7	56.9	51.7
Service	39.0	42.8	37.2	47.2	51.1	44.8
Farm	32.2	51.0	*	36.9	45.4	35.0
Unemployed	40.0	41.0	39.2	56.8	59.9	53.8
Usual activity—homemaking	29.0	37.1	32.2	NA	NA	NA

NOTE: Unknown if ever smoked excluded from calculation.
*Figure does not meet standards of reliability or precision.
SOURCE: National Center for Health Statistics (6).

of 25 (7). In a cohort of individuals born in the same year, a certain percentage of them will begin smoking by age 25. The prevalence of smoking in any birth cohort after age 25 is predominantly determined by the rate at which people stop smoking or die. The prevalence changes over time for each 10 year birth cohort since 1910 for both men and women are presented in the part of this report titled Patterns of Cigarette Smoking.

Women first began smoking cigarettes in large numbers immediately before and during the Second World War (18). Thus, the observed upswing in smoking among women occurred 25 to 30 years after that among men. The birth cohorts with the high-

TABLE 3.—Occupational distribution of men and women, 1978, by percent of each sex employed in each category

	Women	Men
Professional, Technical	15.6	14.7
Sales	6.9	5.9
Clerical	34.6	6.2
Operatives & Transport	11.8	17.7
Service	20.7	8.7
All Other	2.5	11.7
Crafts	1.8	21.1
Managers	6.1	14.0
Total	100	100

SOURCE: Rones, P. (14).

est peak smoking prevalence were born from 1910 to 1930 (men) and from 1920 to 1950 (women). As these cohorts with high prevalence of smoking grow older, they replace cohorts with lower smoking prevalence. Since both occupational diseases and smoking related illnesses increase separately with age, any interaction between the two also could be expected to increase with age. Men in the birth cohort from 1910 to 1930 are now in the age range at which a high incidence of disease would be expected, while those women born from 1920 to 1950 are just beginning to enter the ages at which there is a high prevalence of disease. As a result, the adverse effects of smoking and occupational exposure would be expected to occur more frequently in men, reflecting this difference in the age of the average male and female smoker. This "cohort effect" might lead to the erroneous conclusion that women are protected from occupation–smoking interactions, just as it has been used to suggest that women are protected from the lung cancers induced by cigarette smoking.

A second difference between male and female smoking habits which must be considered is the prevalence of smoking by occupation. Table 1 shows that the prevalence of smoking is reasonably uniform among women employed in many different occupations (the exceptions are education and household area workers with low prevalence and food area workers with high prevalence). There is not the marked difference in smoking habits between female blue collar and white collar workers that has been observed in men (13) (Table 2). A slightly lower prevalence of smoking among professional women compared to other white collar workers occurs similar to that seen in men (7).

The section on behavior in this report discusses the smoking habits of several groups of health professionals. It shows that women physicians and psychologists smoke more heavily than their male counterparts. Thus, the relative levels of smoking observed in the two sexes are reversed for these two occupational groups in comparison to the general population (14). Nurses also have been shown to have a much higher prevalence of smoking than women of the same age in the general population (18). A final notable difference is that, among women, smoking prevalence does not show the same marked inverse correlation with socioeconomic status (7). The reasons for these differences are beyond the scope of this section. However, an understanding of them forms part of the background for any discussion of the interaction of smoking and occupational exposures among women.

Patterns of Employment

The percentage of women in the United States work force is steadily growing. In 1973 women represented 38.4 percent of the United States work force and in 1978 that percentage had risen to 41.2 percent (15).

Approximately 39 million women are employed outside the home. Table 3 clearly indicates that the distribution of women in the labor force by category of work does not parallel that of men. Women are more likely than men to be employed in the clerical and service categories. Men are more likely to be employed in the management, crafts and operatives/transport categories than women. Table 4 lists the number of women employed in a wide variety of occupations, including many of those traditionally believed to be hazardous for men. In spite of this diversity, the bulk of women are employed in a narrow range of jobs. Over one-third of women in the paid labor force are employed in one of the 10 job categories listed in Table 5. All of these categories have been traditional employment areas for women. Thus, the recent gains by women in employment opportunity have not yet had a substantial impact on the actual distribution patterns of the female labor force. If a shift does occur in employment patterns involving greater proportions of women in occupations with significant exposures, we would expect a cohort effect to be apparent in the development of occupational illness. That is, those women entering hazardous occupations traditionally limited to male workers would be expected to be women newly entering the work force and, thus, predominantly in the younger age groups. As these cohorts age, the duration of both occupational and smoking exposures would increase. It is only after these newer cohorts reach the ages where disease is prevalent that we would be able to observe the full